



MARKSCHEME

May 1999

BIOLOGY

Higher Level

Paper 2

SECTION A

1. (a) (i) (*Award 2 marks*)
(accept answers referring to respiration, metabolic, breathing or ventilation rates)
as temperature rises rate falls then levels off / reaches a plateau;
plateau reached above - 10°C;
- (ii) (*Award 2 marks maximum*)
higher (cell) respiration rate / metabolic rate to generate **heat**;
heat needed to maintain body temperature / keep (egg) warm;
rate from -10°C upwards is the base rate / basal metabolic rate / normal rate;
- (b) (*Award 2 marks*)
captive birds - 16.2 kg;
wild birds - 13.3 kg;
negative sign not necessary
penalize once only if units not given using U-1 notation
- (c) (*Award 2 marks maximum*)
both groups lose most of their lipid;
captive birds lose more of their lipids than wild ones;
11.2 kg versus 9.6 kg / 93% lost versus 81% / other valid figures comparing **change**;
- (d) (*Award 2 marks*)
higher (cell) respiration rate / metabolic rate / more fat oxidised in captive birds;
water is produced in (cell) respiration / oxidation of substrates;
- (e) (i) (*Award 1 mark maximum*)
captive birds take in more oxygen;
Captive birds inhale / exhale more;
higher (cell) respiration rate;
- (ii) (*Award 1 mark maximum*)
more water loss in captive birds so they need to take in more water;
birds in tight groups have less access to snow on ground;
- (f) (*Award 3 marks maximum*)
emperor penguins have to maintain body temperature in very cold conditions;
forming groups reduces surface area exposed;
forming groups reduces heat loss;
forming groups reduces need for heat generation;
conservation of food reserves / food/lipids used less quickly;
helps keep the egg warm enough;
ref to value of lipids for insulation;

2. (a) (*Award 2 marks*)
diphtheria / whooping cough / tetanus / other;
measles / polio / rubella / AIDS / other;
- (b) (*Award 2 marks maximum*)
fungi;
protozoa;
flatworms;
roundworms;
- (c) (*Award 3 marks*)
vaccine injected / ingested / vaccination given;
contains weak/killed form of the bacterium/virus;
antibody production (by white blood cells) stimulated;
antibodies / memory cells persist;
refer to booster shots / repeated vaccination;
3. (a) (*Award 1 mark*)
polygenic;
- (b) (*Award 2 marks*)
AaBb;
blue flowered;
- (c) (*Award 5 marks maximum*)
all gametes shown with one allele of each gene only;
four homozygous genotypes shown AABB AAbb aaBB and aabb;
four double heterozygous genotypes shown AaBb;
all of the eight other geneotypes correct;
all of the phenotypes correct;
- (d) (*Award 1 mark*)
9 blue 3 red and 4 white;
- (e) (*Award 1 mark*)
gene A converts white to red and gene B converts red to blue;

SECTION B

(Remember, up to TWO 'quality of construction' marks per essay)

4. (a) *(Award 1 mark for any of the below; up to a maximum of 8 marks)*
condensation / super coiling;
chromatids/identical DNA molecules linked by centromeres;
microtubules/spindle fibres grow from the centrioles/centrosomes;
centrioles/centrosomes move to the poles;
nuclear membrane breaks down;
microtubules from the two poles connect to the kinetochores / centromere;
centromeres divide;
microtubules pull chromosomes/identical DNA molecules to the poles;
tubulin molecules detached by centromere/microtubule motor at centromere;
nuclear membrane forms around chromosomes at each pole;
chromosomes become aligned on the equator;
- (b) *(Award 1 mark for any of the below; up to a maximum of 5 marks)*
cells in a tissue all have the same structure and function;
cells in a tissue all differentiate in the same way;
organs contain different tissues;
to carry out the function of the organ more than one tissue is needed;
organ systems consist of two or more organs;
to carry out the same function in different parts of the body;
to carry out different parts of a common overall process;
tissues are made of cells;
any named example of a tissue **plus** any named example of an organ;
- (c) *(Award 1 mark for any of the below; up to a maximum of 5 marks)*
Advantages of light microscope
colours of material from tissues/organ can be seen;
living material can be studied / less damage to specimen;
cell activities / movement can be studied;
larger field of view;
- Advantages of electron microscope***
greater resolution;
smaller structures can be seen / greater magnification;
- (Award up to 2 marks for the following overall assessment)*
electron microscope better for cells / small structures;
but light microscope better for organs;

(plus 2 quality marks)

5. (a) *(Award 1 mark for any of the below; up to a maximum of 8 marks)*
reactions take place in the stroma;
carbon dioxide reacts with RuBP;
catalysed by RuBP carboxylase;
GP formed;
GP converted to triose phosphate;
reduction reaction involving use of $\text{NADPH} + \text{H}^+$;
energy from ATP also needed from this conversion;
triose phosphate converted to glucose(phosphate)/starch;
RuBP regenerated from triose phosphate;
Calvin cycle;
- (b) *(Award 1 mark for any of the below; up to a maximum of 6 marks)*
light independent reactions involve $\text{ATP/NADPH} + \text{H}^+$ / intermediates which are made in light dependent reactions;
Supply of $\text{ATP/NADPH} + \text{H}^+$ / intermediates used up / runs out in the dark;
ATP and $\text{NADPH} + \text{H}^+$;
GP therefore not reduced /converted to triose phosphate;
RuBP therefore not regenerated;
carbon dioxide fixation therefore stops;
GP accumulates;
stomata close in the dark;
carbon dioxide is therefore not absorbed;
- (c) *(Award 1 mark for any of the below; up to a maximum of 4 marks)*
 CO_2 needed for photosynthesis but not for germination;
 O_2 needed for germination but not for/inhibits photosynthesis;
light needed for photosynthesis but not for/sometimes for/also for germination;
red and blue light best for photosynthesis but red only for germination;
heat stimulates both photosynthesis and germination;
excessive heat inhibits both photosynthesis and germination;

(plus 2 quality marks)

6. (a) *(Award 1 mark for any of the below; up to a maximum of 8 marks)*
synthesised by ribosomes;
free ribosomes/ribosomes not attached to ER;
mRNA is translated;
mRNA binds to the ribosome;
tRNAs bring amino acids;
anticodon on tRNA binds to codon on mRNA;
formation of peptide linkage;
two tRNA's can bind to the ribosome at once;
growing polypeptide linked to amino acid on tRNA;
ribosome moves on down mRNA;
5' to 3';
ref to stop/start codons;
coenzymes added;
- (b) *(Award 1 mark for any of the below; up to a maximum of 4 marks)*
in both models substrate binds to active site;
substrate fits active site exactly in lock and key, but does not in induced fit;
substrate / active site changes shape in induced fit, but does not in lock and key;
in both models an enzyme - substrate complex is formed;
in lock and key binding reduces activation energy but in the induced fit change to substrate reduces activation energy;
lock and key model explains narrow specificity but induced fit allows broader specificity;
induced fit explains competitive inhibition, but lock and key does not;
- (c) *(Award 1 mark for any of the below; up to a maximum of 6 marks)*
competitive inhibitor has similar shape/structure to the substrate;
therefore it fits to the active site;
no reaction is catalysed so the inhibitor remains bound;
substrate cannot bind as long as inhibitor remains bound;
only one active site per enzyme molecule;
substrate and inhibitor compete for the active site;
therefore high substrate concentrations can overcome the inhibition;
as substrate is used up ratio of inhibitor to substrate rises;
named example of inhibitor plus inhibited enzyme / process / substrate;

(plus 2 quality marks)

7. (a) *(Award 1 mark for any of the below; up to a maximum of 8 marks)*
mitosis;
in the germ layer/germinal epithelium;
spermatogonia produced;
mitosis to allow many cells to be produced/continuous cell production;
cell growth;
enlarged cells are primary spermatocytes;
meiosis;
diploid to haploid;
two divisions of meiosis;
secondary spermatocytes produced by first division/carry out second division;
spermatids formed by (second division of) meiosis;
differentiation into spermatozoa/mature sperm cells;
growth of tail / acrosome / other feature;
ref to role of Sertoli cells;
- (b) *(Award 1 mark for any of the below; up to a maximum of 5 marks)*
LH levels rise and stimulate more testosterone production;
testosterone levels are very low before puberty;
testosterone levels rise during puberty;
testosterone causes puberty / secondary sexual characteristics;
testosterone has many target organs in the body;
example of target organs and response;
ref to sequence of changes being related to level of testosterone needed;
testosterone stimulates sperm production;
FSH levels rise and cause sperm maturation;
- (c) *(Award 1 mark for any of the below; up to a maximum of 5 marks)*
ethical arguments against
intercourse should only be used for procreation / contraception is against natural law /
against religious beliefs;
contraception encourages promiscuity;
reference to death of embryos
damage to traditional family structures;
- (Award 4 points maximum)*
ethical argument for
prevent unwanted children / children who cannot be cared for;;
helps reduce human population growth;
reduces suffering due to STDs/prevent AIDS;
reduces abortion rate;
mother's right to choose;

(plus 2 quality marks)
